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09/625,094	07/25/2000	Frederick M. Discenzo	00RE089	6257

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Please find below and/or attached an Office communication concerning this application or proceeding.

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/625,094
Filing Date: July 25, 2000
Appellant(s): DISCENZO, FREDERICK M.

Himansu S. Amin
For Appellant

MAILED
FEB 23 2005
GROUP 2800

EXAMINER'S ANSWER

This is in response to the appeal brief filed 11/30/04.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The rejection of claims 1-21, 24-27, and 37-43 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

5,399,854	Dunphy *et al.*	3-1995
5,361,130	Kersey *et al.*	11-1994
4,460,893	Thomas *et al.*	7-1984
5,382,097	Ide	1-1995
5,473,428	Lee *et al.*	12-1995

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-12, 14-21, and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dunphy, *et al.* (US 5,399,854) in view of Kersey, *et al.* (5,361,130) and Thomas, *et al.* (4,460,893).

Dunphy, *et al.* show an embedded optical sensor capable of strain and temperature measurement comprising:

a least one optical fiber (21) embedded in a sample to be measured, the at least one optical fiber being adapted to transmit light from a light source; and

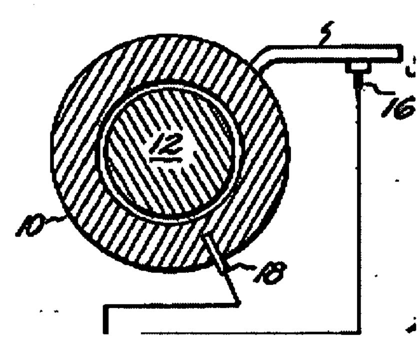
an interferometric system (28) operatively couple to the optical fiber;

wherein the interferometer system provides information relating to at least one condition of the sample, and a state of the at least one condition of the sample based on the information is determined.

Dunphy, *et al.* do not expressly show a processor and does not show that the sample being measured is a bearing.

Kersey, *et al.* show a fiber optic sensing system having a processor. At the time of the invention, one of ordinary skill in the art would have used a processor with Dunphy, *et al.* in order to count and convert the fringe signals from the sensors into the temperature that is being indicated by the sensor.

As for the bearing, Thomas, *et al.* show a sensor (18) embedded in a bearing (10) to monitor the bearing temperature wherein in the sensor (18) is embedded parallel to the direction of wear of the bearing (10).



At the time of the invention, one of ordinary skill in the art would have replaced the sensor of Thomas, *et al.* with the fiber optic sensor of Dunphy, *et al.* in order to have a simpler

sensor having a wider range of temperature measurement, and also measures temperature more accurately.

As for claims 2, 10, 16 Thomas, *et al.* show that monitoring the temperature of the bearing indicates the rate of wear of the bearing (Abstract).

As for claims 4 and 5, Dunphy, *et al.* show that a reference beam and a measurement beam in created and that an interference beam in created by the reflected reference and measurement beam.

As for claims 8 and 9, none of the cited reference show that the bearing is a ball bearing, hydrodynamic, double row ball, and thrust bearings however, those types of bearings are notoriously well known. At the time of the invention, one of ordinary skill in the art would have used sensors in ball bearings to monitor the condition of the bearings.

As for claim 15, please see Figure 7 of Kersey, *et al.*

As for claim 16, none of the references show that the sensor end of the fiber is flush with a contacting surface of the bearing, however, Thomas, *et al.* teach that the sensor should be place as close as possible to the load bearing point, therefore one of ordinary skill in the art would have been motivated to place the sensor flush with the contacting surface of the bearing since that point is a load bearing point in order to obtain the most accurate measurement of the temperature of the load bearing point.

3. Claims 13, 27, 37-43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dunphy, *et al.*, Kersey, *et al.* and Thomas, *et al.* as applied to claims 1-12, 14-21, and 24-27 above, and further in view of Ide (5,382,097).

Dunphy, *et al.*, Kersey, *et al.* and Thomas, *et al.* show all the elements but do not show an actuator.

Ide shows a smart bearing comprising an actuator. At the time of the invention, one of ordinary skill in the art would have modified Dunphy, *et al.*, Kersey, *et al.* and Thomas, *et al.* with an actuator of Ide in order to maintain proper bearing support while monitoring the pressure environment of the sensor (column 17, lines 47+).

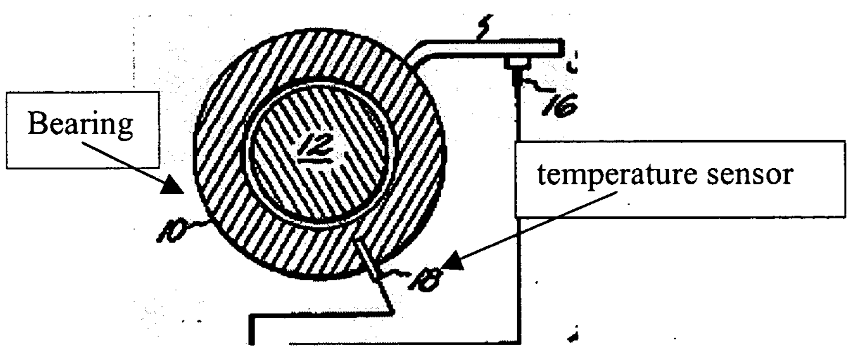
(11) Response to Argument

1. <u>Applicant's arguments regarding claims 1-12, 14-21, and 24-27</u>

In response to Applicant's argument that neither Dunphy, *et al.* nor Kersey, *et al.* show a motivation to be combined (Applicant's Appeal Brief, page 4), the Office submits that the motivation to combine is within the knowledge generally available to one of ordinary skill in the art. It is within the knowledge generally available to one of ordinary skill in the art that interferometric fiber optic temperature sensors have advantages over thermocouple temperature sensors. Some advantages are: better immunity to detrimental electromagnetic fields, higher accuracy, and wider measuring range. To demonstrate that this knowledge is generally available to one of ordinary skill in the art, Lee *et al.* (US 5,473,428) show an interferometric fiber optic sensor and states,

"A thermocouple or resistive temperature detector (i.e., RTD) is typically used for general methods of electrically measuring the temperature of heat-emitting objects, objects within a hot environment or an ambient temperature of a hot (i.e., beyond room temperature) environment. Temperature measuring meters using such above methods have problems however, with electromagnetic interference (EMI), accuracy, response speed, and resolution. Also, there is a problem in that high temperatures are not easily measured. To solve many of the problems associated with the above mentioned temperature measuring means, an interferometric temperature measuring method has been developed."

With this knowledge, the Office submits that it would have been obvious to combine Dunphy, *et al.* and Thomas, *et al.* Thomas, *et al.* show a bearing (10) wherein a thermocouple temperature sensor (18) is embedded in the bearing (10) to measure and monitor the temperature of the bearing (10). Shaft (12) rotates inside the bearing (10) within a layer of oil, and the lack of the lubricating layer of oil can cause the temperature of the bearing to increase.



Dunphy, *et al.* show an interferometric fiber optic temperature sensor. Dunphy, *et al.* however does not show every possible sample that can be measured by the fiber optic temperature sensor. Since Thomas, *et al.* show the motivation to measure the temperature of a bearing, one of ordinary skill in the art would have used the fiber optic temperature sensor of Dunphy, *et al.* to measure the temperature of a bearing and in particular, replaced the

thermocouple temperature sensor of Thomas, *et al.* with the fiber optic temperature sensor since it is within the knowledge generally available to one of ordinary skill in the art that interferometric fiber optic temperature sensors have advantages over thermocouple temperature sensors such as higher accuracy, better immunity to detrimental electromagnetic fields, and a wider measuring range.

Applicant argues that the combination of Thomas, *et al.* and Dunphy, *et al.* would not yield a simpler system (Applicant's Appeal Brief, page 7) because the multiple layers and filaments must be incorporated. The Office agrees with the Applicant and withdraws the motivation "for a simpler system" but maintains that "more accurate measurements" and "wider temperature range" are motivations to combine Thomas, *et al.* and Dunphy, *et al.,* these motivations being generally known to one of ordinary skill in the art as demonstrated by Lee, *et al.*

It appears that the Applicant is arguing it would be problematic to embed the sensor of Dunphy, *et al.* in the bearing (Applicant's Appeal Brief, page 6, first full paragraph) because bearings do not already contain the multiple layers and filaments. In response, the Office was not looking to Thomas for the teaching a bearing having layers and filaments. Rather, Dunphy, *et al* teach that the sensor as a whole is a combination of a fiber optic within a composite structure, the composite structure having layers with filaments. The Office submits that one of ordinary skill would embed the sensor in its entirety in the sample to be measured, the sensor comprised of an fiber optic within a composite structure. In the instant case, the sample being a bearing. Thus, the sample (bearing) does not need layers and filaments. If the sensor of Dunphy,

et al can only be used to measure samples that have layers and filaments as the Applicant suggests, there would be very few, if any, samples which can be measured. The Office submits that the sensor of Dunphy, *et al.* is not solely an optical fiber, but rather that the sensor is an optical fiber in combination with a composite structure.

Applicant argues that the cited references do not disclose *an end of an optical fiber being flush with a contacting surface of a bearing*. The Office submits that one of ordinary skill would have placed the fiber optic sensor flush with the contacting surface of a bearing in order to obtain an even more precise temperature measurement of the bearing. Thomas, *et al.* show that the thermocouple temperature sensor should be placed close to the maximum load bearing point (contacting surface of the bearing) in column 3, lines 30-33. The Office submits that a skilled artisan would understand from this teaching of Thomas, *et al.* that the closer the temperature sensor is to the contacting surface, the higher the precision in measuring the critical temperature of the bearing. One of ordinary skill in the art would understand that the further away the sensor is from the contacting surface, the more there would be a delay in the measurement of any temperature change of the bearing in addition to possibly getting the wrong temperature of the load bearing point. With this understanding, the Office submits that one of ordinary skill in the art would be motivated to place the temperature sensor flush at the contacting surface in order to measure the temperature as accurately and timely as possible.

The Applicant also argues that the skilled artisan would not have placed the thermocouple sensor flush with the surface because the wearing away of the junction of the thermocouple would render the sensor useless. The Office agrees that once the junction has

worn away enough, the sensor would be rendered useless, however one of ordinary skill in the art would recognize the compromise necessary between sensor longevity and sensor accuracy and would have selected the location of the sensor accordingly. In the situation where temperature accuracy is desired, the skill artisan would have placed the sensor immediately (flush) at the contact surface and would have done so with either the thermocouple temperature sensor or the fiber optic temperature sensor.

2. Applicant's arguments regarding claims 13, 27, and 37-43.

In response to Applicant's argument that Ide fails to show or to suggest an optical fiber embedded in a bearing, the Office was not relying on Ide for the teaching, but rather the combination of the teachings of Thomas, *et al.* and Dunphy, *et al* to obtain ***an optical fiber embedded in a bearing.***

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Hwa (Andrew) Lee, Examiner 2877
February 15, 2005

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